## REMARKS

Claims 1-32 are currently pending in the application; with claims 1 and 17 being independent. Claims 1-32 were pending prior to the Office Action.

The Examiner is respectfully requested to reconsider the rejections in view of the amendments and remarks set forth herein. Applicant respectfully requests favorable consideration thereof in light of the amendments and comments contained herein, and earnestly seeks timely allowance of the pending claims.

### *Claim Rejections – 35 USC §103*

The Examiner rejected claims 1-14, 16-30 and 32 under 35 U.S.C. § 103(a) as being unpatentable over US Patent Application 2004/0264780 ("Zhang et al.") in view of US Patent 6,873,713 ("Okazaki et al.") and publication "Growing Gaussian Mixture Models for Pose Invariant Face Recognition", IEEE, pp. 1088-1091 ("Ralph et al."). The Examiner rejected claims 15 and 31 under 35 U.S.C. § 103(a) as being unpatentable over Zhang et al., Okazaki et al. and Ralph et al., further in view of US Patent Application 2002/0122596 ("Bradshaw"). Applicant respectfully traverses these rejections.

Applicant respectfully submits the Examiner has failed to establish a *prima facie* case of obviousness.

To establish a *prima facie* case of obviousness, the Examiner has the burden of meeting the basic criterion that the prior art must teach or suggest all of the claim limitations.

Regarding this basic criterion, the Applicant submits that Zhang et al., Okazaki et al., Ralph et al. and Bradshaw do not disclose or suggest applying each extracted feature to a previously-determined additive probability model to determine the likelihood that the object of interest belongs to an existing class of objects, wherein said additive probability model models the objects using a class center and residual components between the objects and the class center, as claimed in claim 1.

Zhang et al., Okazaki et al. and Bradshaw do not disclose or suggest applying each extracted feature to a previously-determined additive probability model to determine the likelihood that the object of interest belongs to an existing class of objects, wherein said additive

probability model models the objects using a class center and residual components between the objects and the class center. The Examiner recognized (page 3 of the Office Action) that an additive probability model as claimed in claim 1 is not taught by Zhang et al. and Okazaki et al. Bradshaw also does not determine the likelihood that an object of interest belongs to an existing class of objects using a previously-determined additive probability model. The Examiner used Ralph et al. to allegedly teach an additive probability model that models the objects using a class center and residual components between the objects and the class center (page 4 of Office Action).

The teachings of Ralph et al. are described below. Applicant submits that an additive probability model that models the objects using a class center and residual components between the objects and the class center is not taught by Ralph et al., as further explained below.

Ralph et al. merely discloses Gaussian mixture models to characterize human faces and model pose variance with different numbers of mixture components, where the optimal number of mixture components for each person is automatically learned from training data by growing the mixture models (Abstract).

The Examiner stated on page 4 of the Office Action that Ralph et al. allegedly discloses an additive probability model because it discloses a Gaussian model. Applicant points out that Gaussian is not synonymous with additive. In fact, Gaussian and additive have separate meanings. For example, a bell-shaped curve may represent a Gaussian distribution, but the bell-shaped curve may be missing an additive property. Hence, a model may be Gaussian but not additive. The fact that Ralph et al. discloses a Gaussian model does not indicate that Ralph et al. discloses an additive probability model.

A mixture model, as disclosed in Ralph et al., is a weighted sum of mixture components. The weighted sum of the mixture components is associated with a new face image $x$. This is explained on page 1089, Section 3.3 in Ralph et al. Specifically, for a face image $x$ and classes $C_k$ (each class representing a different person), probability $p(C_k \mid x)$ that $x$ belongs to class $C_k$ is calculated. The class conditional probability $p(C_k \mid x)$ is modeled with a Gaussian mixture

model as expressed by equation (1) (bottom of page 1089) $p(x \mid C_k) = \sum_{j=1}^{M} p(x \mid j)P(j)$ which is a mixture (a weighted sum) of $M$ Gaussian distributions $p(x \mid j)$.

The Examiner stated that a "characterized human face or identity" in Ralph et al. allegedly represents a class center. However, in the mixture model of Ralph et al., the only entity that corresponds to a human identity is a class $C_k$ itself, which cannot represent a class center for itself. The face image $x$ (mentioned on page 1089) is not a "characterized human face or identity", because $x$ is a new (uncharacterized) face that needs to be assigned to a class. Furthermore, there is no mention of a class center for a class $C_k$. Rather, each class $C_k$ is associated with multiple Gaussian distributions $p(x \mid j)$ which are weighted and added together. Ralph et al. does not indicate that any of the Gaussian distributions (mixture components) is a class center.

Residual components between objects and a class center are also not disclosed in Ralph et al. The Examiner stated on page 4 of the Office Action that residual components between objects and a class center is allegedly read as a view or a pose. However, Ralph et al. does not calculate any residual component between a class center and a face view. Ralph et al. adds multiple Gaussian distributions $p(x \mid j)$ in a weighted sum, and none of these Gaussian distributions $p(x \mid j)$ represents a class center. No Gaussian distributions are calculated as a residual component between a face view and a class center.

The Examiner is basically alleging that one of the components in the mixture model is a class center, and that the other components represent residual components associated with different face views. However, in Ralph et al., no mixture component is more important than the other components. All mixture components in Ralph et al. are added together in a weighted sum, as described by equation (1) on page 1089. Hence, Ralph et al. uses multiple, equally ranked components in a weighted sum, and determines the best number of components (mixtures) $M$ to maximize class conditional probability $p(x \mid C_k)$ for a new face image $x$. The mixture components of Ralph do not represent a reference view and other non-reference views. The mixture components of Ralph are mathematical entities such as eigenvectors (PCA components)

obtained by principal component analysis (page 1090 third paragraph, line 6), and these components are weighted and added together to produce various poses. Hence, no mixture component is a class center, and a view is not expressed as a residual component in Ralph. On the contrary, any view is expressed by a weighted sum of mixtures as in equation (1) (page 1089), using an optimized number of mixture components. Finally, the word "variance" that appears in the abstract of Ralph et al. (line 10) does not indicate residual components between objects and a class center. The word variance simply indicates that the model of Ralph et al. can characterize various human poses using different numbers of mixture components (see abstract lines 9-11).

Hence, Ralph et al. does not teach or suggest applying each extracted feature to a previously-determined additive probability model to determine the likelihood that the object of interest belongs to an existing class of objects, wherein said additive probability model models the objects using a class center and residual components between the objects and the class center, as claimed in claim 1.

Consequently, the asserted combinations of Zhang et al., Okazaki et al., Ralph et al. and Bradshaw (assuming these references may be combined, which Applicant does not admit) fails to establish *prima facie* obviousness of claim 1 or any claim dependent therefrom. Independent claim 17 and claims depending therefrom define over of Zhang et al., Okazaki et al., Ralph et al. and Bradshaw at least based on reasoning similar to that set forth above.

For all of the above reasons, taken alone or in combination, Applicant respectfully requests reconsideration and withdrawal of the 35 U.S.C. § 103 (a) rejection of claims 1 and 17. Claims 2-16 depend from claim 1 and are allowable at least by virtue of their dependency. Claims 18-32 depend from claim 17 and are allowable at least by virtue of their dependency.

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## Conclusion

In view of the above amendments and remarks, this application appears to be in condition for allowance and the Examiner is, therefore, requested to reexamine the application and pass the claims to issue.

Should there be any outstanding matters that need to be resolved in the present application, the Examiner is respectfully requested to contact Corina E. Tanasa, Limited Recognition No. L0292 under 37 CFR §11.9(b), at telephone number (703) 208-4003, located in the Washington, DC area, to conduct an interview in an effort to expedite prosecution in connection with the present application.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 02-2448 for any additional fees required under 37 C.F.R. §§ 1.16 or 1.17; particularly, extension of time fees.

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Respectfully submitted,

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